GPH12/DPH12 — CLASSICAL AND STATISTICAL MECHANICS

Time : Three hours   Maximum : 75 marks

SECTION A — (10 × 2 = 20 marks)

Answer ALL questions.

1. What are constraints? Classify them.

2. List the properties of Poisson's bracket.

3. What are Action-Angle variables?

4. State Kepler's law.

5. Define moments of inertia tensor. Give its physical significance.

6. What do you understand from degrees of freedom?

7. Distinguish between first and second order phase transition.

8. For what kind of atoms, Sackur - Tetrode formula is valid.

9. What is meant by idle gas?

10. Write a note on thermionic emission.

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SECTION B — (5 × 5 = 25 marks)

Answer ALL questions.

11. (a) Prove that Poisson brackets are invariant under canonical transformation.

Or

(b) Derive Hamilton's equations of motion.

12. (a) Obtain Hamilton's Jacobi equation.

Or

(b) Discuss the theory of small oscillations and hence obtain eigen frequencies of small oscillations.

13. (a) Explain Euler angles and hence derive Euler's equation of motion.

Or

(b) Write a note on (i) Precession (ii) Nutation

14. (a) What are ensembles? Explain different types of ensembles.

Or

(b) Explain Liouville theorem and tell its significance.

15. (a) What is Bose-Einstein condensate? Explain in detail.

Or

(b) Discuss Pauli's theory of para magnetism

SECTION C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. Derive Lagrange's equation of motion from D'Alembert's principle

17. Apply Hamilton — Jacobi theory to solve linear harmonic oscillator problem and hence obtain characteristic frequencies.

18. Describe the motion of a symmetrical top under the action of gravity.

19. Explain in detail about Brownian motion by Langevin theory.

20. Derive Planck's law of radiation and mention its limitations.

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